Revisiting "Money Illusion":

Replication and Extension of Shafir et al. (1997)

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Authorship Declaration:

Gilad led the replication efforts, supervised each step in the project, conducted the pre-registrations, and ran data collection. Kamath Anvita Anil, Tsun Shue Man, Lei Hoi Ching, and Li Jie conducted the replication and extension. Bo Ley Cheng guided and assisted the replication effort in the PSYC3052 and PSYC2071 courses. Ignazio followed up on the initial work by the other coauthors to verify analyses and conclusions as well as to perform new analyses. He also completed the manuscript submission draft. Ignazio and Gilad jointly finalized the manuscript for submission.

In the table below, we employ CRediT (Contributor Roles Taxonomy) to identify the contribution and roles played by the contributors in the current replication effort. Please refer to the URL (https://www.casrai.org/credit.html) on details and definitions of each of the roles listed below.

Role	Ignazio Ziano	Kamath Anvita Anil, Tsun Shue Man, Lei Hoi Ching, Li Jie	Boley Cheng	Gilad Feldman
Conceptualization		X		X
Pre-registration		X		
Data curation				X
Formal analysis	X	X		
Funding acquisition				X
Investigation	X	X		X
Methodology		X		X
Pre-registration peer review / verification	X	X	X	X
Data analysis peer review / verification	X	X		
Project administration				X
Resources				X
Software	X	X		X
Supervision			X	
Validation	X			X
Visualization	X			
Writing-original draft	X	X		
Writing-review and editing	X			X

Abstract

Shafir, Diamond, and Tversky (1997) described money illusion as people's inclination to think of money without taking inflation sufficiently into account, i.e., in nominal terms rather than in real terms. We successfully replicated Problems 1 to 4 of Shafir, Diamond, and Tversky's study (1997) on money illusion (MTurk; N = 604). We found effect sizes in line with the original ones for assessments of income (Problem 1; original: Cramer's V = 0.26, 95% CI [0.17, 0.37]; replication: V = 0.28 [0.21, 0.36]), transactions (Problem 2; original: 48% [42%, 52%]; replication: 70% [66%, 73%]), sales and consumption (Problem 3; original buy: 38% [33%, 43%]; replication buy: 47% [43%, 51%]; original sell: 43%% [38%, 48%]; replication sell: 43% [39%, 47%]), and contracts (Problem 4; original: V = 0.25 [0.13, 0.42]; replication: V = 0.17 [0.10, 0.25]). With an added extension, we found no support for the notion that knowing about or correctly estimating the inflation rate affected money illusion. We discuss theoretical implications for the study of money illusion and the psychological meaning of inflation, as well as for the understanding of the antecedents of money illusion. All data, code, and materials are available on https://osf.io/rv9mw/ .

Keywords: Money Illusion, Nominal and real values, Nominal Framing, Replication, Judgement and decision making

Revisiting "Money Illusion": Replication and Extension of Shafir et al. (1997)

Money illusion is the tendency to think about money in nominal rather than real terms. If there is inflation, money loses value over time. Money illusion leads people to fail to consider the impact of inflation on the real value of money. There are many theoretical and practical consequences of money illusion – for instance, the reluctance to sell a house or a stock at a nominal loss (but a real gain) in times of deflation, or the oversized appreciation of a nominal wage raise that is actually a real wage cut in times of high inflation. Shafir et al. (1997 – "Money Illusion") used survey experiments to show that Princeton undergraduates, Newark airport passengers, and New Jersey mall visitors exhibited a high degree of money illusion. They found money illusion when people considered salaries, everyday shopping issues, real estate transactions, and commercial transactions, especially when the transaction was framed in terms that were not strictly economic (e.g., when asking about job satisfaction, rather than the economic situation). In the present investigation, we report a successful replication of Problems 1 to 4 of Shafir et al. (1997) with added extensions.

We decided to replicate "Money Illusion" because of three factors, explained in further detail in the following section. First, it is an influential article; second, there are conflicting findings about the existence of money illusion in the literature; third, to the best of our knowledge, there are no direct or very close replications of this finding.

The Impact of "Money Illusion"

"Money Illusion" has had a major impact within the fields of economic psychology and behavioural economics, and it was cited 1045 times on Google Scholar at the time of writing this article. Shafir et al. (1997) proposed that money illusion can explain wages and contract "stickiness", in direct contrast with economic models that posit full rationality in

agents, such as the quantity theory of money (Akerlof et al., 1996). When money illusion is present, people think of money in nominal rather than real terms, and are therefore slower than rational – but theoretical - agents to adjust to changes in inflation, a phenomenon known as “nominal inertia”. The causal impact of money illusion on nominal inertia was further developed by Fehr and Tyran (2001), who, drawing on the results of an incentivized experiment, argued that money illusion is responsible for slow adjustments in prices and wages, especially after a negative shock.

The Extent of Money Illusion

Some studies argue that the extent of money illusion has been overestimated. Petersen and Winn (2014) argued that the results in Fehr and Tyran (2001) were due to an experimental artefact. Bittschi and Duppel (2015) investigated actual charity donations before and after the introduction of the euro in Germany, and found evidence for a much weaker degree of money illusion compared to Shafir et al. (1997). Duffy and Puzzello (2014), using incentivized lab experiments, found some support for the hypothesis that money is indeed neutral, and people adjust for inflation. Finally, Grundmann and colleagues (2019) argued that what Shafir et al. (1997) found was not money illusion, but the product of employees’ inferences of employers’ intentions. Compare Company A, which raised salaries by 5% in light of 12% inflation, with Company B, which lowered salaries by 7% in light of no inflation. While the results in real terms are the same, Grundmann and colleagues argue that people will infer benevolent intentions in the former case, and exploitative intentions in the latter, and therefore prefer the former, a phenomenon erroneously interpreted as money illusion. Note that these objections only apply to Problem 1 of Shafir et al. (1997), as the other problems also find evidence in favour of money illusion but are set in different contexts (commercial contracts, consumer purchases).

These findings do not directly call in question the phenomenon of money illusion, yet seem to suggest that money illusion is more nuanced than originally suggested in Shafir et al. (1997). Overall, we believe it is important to test the replicability of such an important result, especially given rising concerns over large-scale replication efforts in the social sciences (Camerer et al., 2018; Klein, Hasselman, et al., 2018; Klein et al., 2014).

"Direct" versus "Conceptual" Replications

Previous replications of "Money Illusion" (Jureviciene & Markelova, 2016; Mees & Franses, 2015) were heavily adapted to the local context (Lithuania during the transition to the euro and China respectively), changing the context, language, and examples. These two papers may therefore be categorized as "distant" or "conceptual" replications (LeBel, Vanpaemel, Cheung, & Campbell, 2018).

Very close replications (or "direct replications") strive to remain similar to the original (LeBel et al., 2018). This type of replication has important theoretical value because it attempts to minimize the number of factors (e.g., wording, stimuli, procedure, context) to which the replication results can be attributed in a conceptual replication (Simons, 2014; Zwaan, Etz, Richard, & Donnellan, 2017), therefore allowing for the highest possible degree of falsifiability of the original results (LeBel, Berger, Campbell, & Loving, 2017). Direct, independent replications have an *a priori* unique theoretical value independent of their results, as they assuage potential issues of publication bias (Smaldino & McElreath, 2016; Zwaan et al., 2017). Large majorities of academic psychologists see direct replications as important and valuable, and believe that more direct replications should be published (Agnoli, Fraser, Thorn, & Fidler, 2020).

Extension: Correlates of Money Illusion - Knowledge, Tracking, and Caring

Shafir et al. (1997, p. 347) argued that while people know the value of money in real terms (that is, they adjust for inflation), the nominal *representation* of money is more salient

and simpler than the real one. This leads people to take into account the nominal value of money while they should not and thus causes money illusion.

We reason that participants who know the inflation rate may be less affected by money illusion, and that participants who report to care about inflation and tracking it may display reduced money illusion. We extend the findings presented in Shafir et al. (1997) by investigating whether people's own estimations of the inflation rate and their level of attention to inflation are associated with money illusion. This extension is theoretically important as it may shed light on potential antecedents to money illusion, by linking it directly with unawareness of inflation or economic ignorance.

Outline of Replication and Extension

Pre-registrations and Open Data

Pre-registrations, disclosures, power analyses, and all materials are available in the supplementary materials. These, together with datasets and code, were made available on the OSF at https://osf.io/rv9mw/. All measures, manipulations, and exclusions for this investigation are reported, and data collection was completed before analyses. Pre-registration is available on OSF at https://osf.io/fve58.

Participants, Procedures and Power Analyses

Participants completed Problems 1 to 4 of Shafir et al. (1997) (presented in random order) as part of a larger set of experiments. We chose to focus on these four problems as they represented simple money illusion demonstrations in different contexts without the complexity added by combining money illusion with the other phenomena (mental accounting and fairness concerns) investigated in Problems 5 to 7. Our final sample size was determined by the budget allocated for this project, and was larger than the estimated required sample (166, see supplementary materials for details). We recruited 604 participants from Mechanical

Turk (MTurk; 288 males, 315 females, 1 other, M_{age} = 40.09, SD_{age} = 11.48). Sensitivity analyses indicated that this sample had approximately 99.99% power to detect all the original effects with a two-sided $\alpha = 0.05$.

MTurk samples produce very similar results to U.S. representative samples (Coppock, 2017; Coppock, Leeper, & Mullinix, 2018; Mullinix, Leeper, Druckman, & Freese, 2015) and have been used extensively to successfully replicate studies originally performed with other U.S. American populations (e.g., Jung, Moon, & Nelson, 2019; Ziano, Mok, & Feldman, 2020).

Extension

Before participants started the experiment, they were asked a series of questions about the inflation rate in the USA in 2017, which was the last full year for which inflation rate was available at the moment of data collection. This appeared before the replication, so that it would not be affected by questions regarding money illusion. However, it is possible that they may have affected replication findings by making people aware of inflation. We added instructions to address the possibility of participants searching for the inflation rates, though we could not confirm adherence. Participants were asked whether they knew the inflation amount in the USA in 2017 (Yes/No). If they answered "Yes", they were asked to estimate the USA inflation in 2017, and rate their confidence in their answer (1 = *not at all*, 3 = *neutral*, 5 = *very confident*). Participants then indicated whether they tracked inflation (Yes/No) and cared about inflation rate (1 = *not at all*, 3 = *neutral*, and 5 = *very much*). Descriptive statistics are summarized in Table 1. We present the extension results after the replication results.

Table 1

Descriptive Results, Extension Measures

Knowledge	Tracking	Care	Confidence	Estimate
		M (SD)	M (SD)	M (SD), *Median*
48/604 (8%)	51/604 (8%)	3.00 (0.98)	3.75 (0.89)	4.84 (11.18), *2.10*

Note: Knowledge and tracking results represent how many participants reported that they knew and tracked the inflation rate. The results of "Care" are relative to the whole sample. Results about confidence and estimation of the inflation rate are only relative to the 48 participants who reported that they knew the inflation rate.

Problem 1 Replication

Problem 1 tested two hypotheses. The first was that people are subject to money illusion, and believe that workers would be less happy with a job and more willing to quit a job if they received a salary raise that is higher in real terms, but lower in nominal terms. The second was that describing a problem in economic terms, without asking about happiness or job attractiveness, reduces money illusion.

Methods

Participants were presented with the scenario presented in Table 2. Then, they were randomly assigned to answer one of three questions: (1) who was doing better in economic terms (economic terms condition, n = 200), (2) who was happier with the job (happiness condition, n = 203), and (3) who was more likely to quit their job for another one after a year (job attractiveness condition, n = 201) between Ann, with a higher salary raise in *real* terms, and Barbara with a higher salary raise in *nominal* terms.

In "Money Illusion", a majority of participants (71%) indicated Ann as doing better than Barbara in economic terms. However, only a minority (36%) rated Ann as being the

happier one, and a majority (65%) believed that Ann was more likely to leave her job than Barbara.

Table 2

Problem 1: Scenario and Conditions

Introduction	Conditions		
	Economic Terms	Happiness	Job satisfaction
Consider two individuals, Ann and Barbara, who graduated from the same college a year apart. Upon graduation, both took similar jobs with publishing firms. Ann started with a yearly salary of $30,000. During her first year on the job there was no inflation, and in her second year, Ann received a 2% ($600) raise in salary. Barbara also started with a yearly salary of $30,000. During her first year on the job, there was a 4% inflation, and in her second year, Barbara received a 5% ($1500) raise in salary.	As they enter their second year on the job, who was doing better in economic terms?	As they enter their second year on the job, who do you think was happier?	As they enter their second year on the job, each received a job offer from another firm. Who do you think was more likely to leave her present position for another job?

Results and Discussion

We found that a majority of participants (56%) indicated Ann as doing better than Barbara in economic terms. Only a minority (35%) rated Ann as being the happier one, and a majority (69%) believed that Ann was more likely to leave her job than Barbara. Overall, people showed a higher degree of money illusion when the problem was described in happiness and job attractiveness terms compared to when it was described in economic terms. While there was one comparison against 50%, which was statistically significant in the original Problem 1 and not in ours (the economic terms condition), when we consider the overall pattern, we conclude that this replication was successful, as the overall statistical test was significant and the pattern of choice very similar to the original study (see Table 3 and Figure 1).

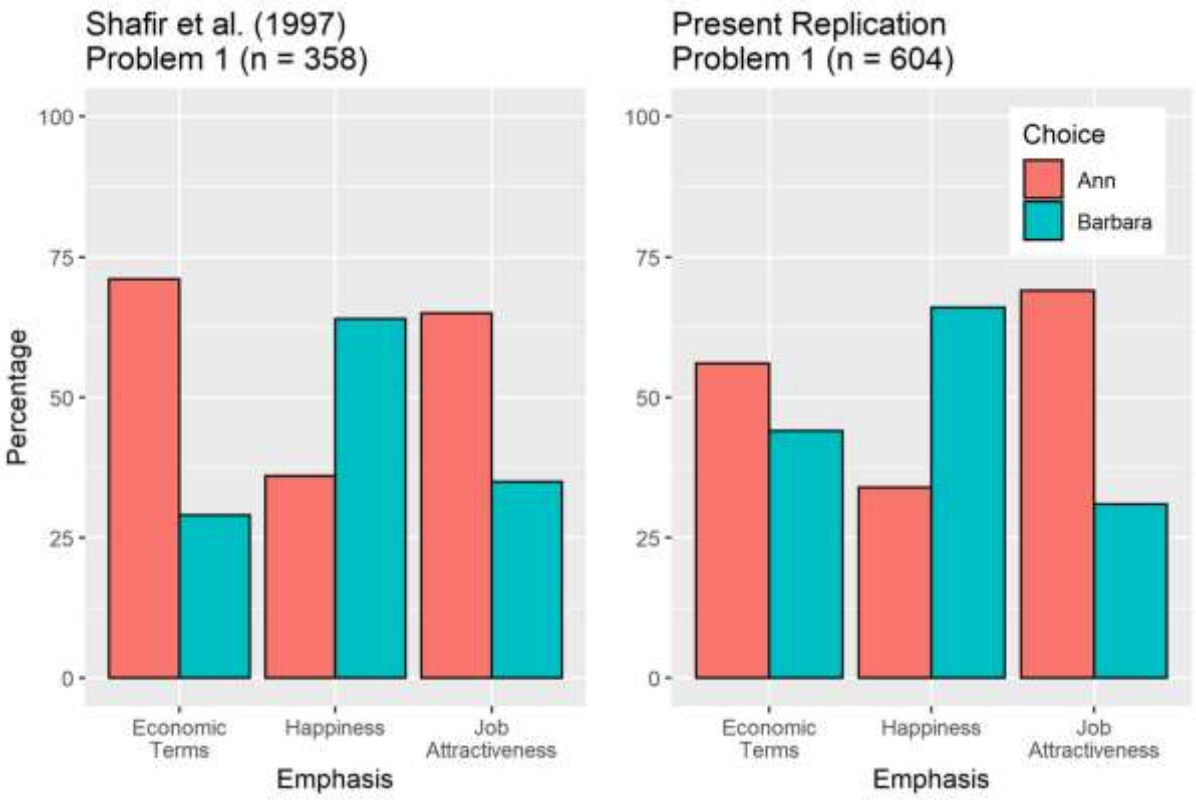

Figure 1. Problem 1: Comparison of results, target article and its replication.

Table 3

Problem 1: Original Study and Replication Results

	Original Problem 1 (Earnings)				Replicated Problem 1 (Earnings)			
	Economic Terms	Happiness	Job Attractiveness	Total	Economic Terms	Happiness	Job Attractiveness	Total
Ann	106 (71% [63%, 77%])	25 (36% [26%, 48%])	90 (65% [56%, 72%])	221	111 (56% [49%, 62%])	70 (35% [28%, 41%])	138 (69% [62%, 75%])	319
Barbara	44 (29% [23%, 37%])	44 (64% [52%, 74%])	49 (35% [28%, 43%])	137	89 (44% [38%, 51%])	133 (66% [59%, 71%])	63 (31% [25%, 38%])	285
Total	150	69	139	358	200	203	201	604
p-value*	< .001†	= .007†	< .001†		= .14	< .001	< .001	
Total p-value**	< .001†				< .001			
Cramer's V**	0.26 [0.17, 0.37]†				0.28 [0.21, 0.36]			

Note: † recalculated p- value or effect size.
* indicates the p-value relative to a binomial test against a proportion of 50%
**indicates the p-value relative to a test of association between proportion
The values in square brackets refer to 95% confidence intervals around proportions, calculated following the method described in Newcombe (1998).

Problem 2 Replication

In Problem 2, Shafir et al. (1997) tested whether people show money illusion in hypothetical real estate transactions.

Methods

Participants were presented with a scenario about real estate transaction (Table 4), and then ranked three house-sellers (Adam, Ben, and Carl) in terms of the success of their transactions, assigning "1" to the person who made the best deal and "3" to the person who made the worst deal. The order in which the sellers were presented was randomized.

Table 4

Scenario and Conditions, Problem 2

	Traders		
Introduction	Adam	Ben	Carl
Suppose Adam, Ben and Carl each received an inheritance of $200,000, and each used it immediately to purchase a house. Suppose that each of them sold the house a year after buying it. Economic conditions, however, were different in each case:	When Adam owned the house, there was a 25% deflation--the prices of all goods and services decreased by approximately 25%. A year after Adam bought the house, he sold it for $154,000 (23% less than he paid).	When Ben owned the house, there was no inflation or deflation--prices had not changed significantly during that year, He sold the house for $198,000 (1% less than he paid for it).	When Carl owned the house, there was a 25% inflation--all prices increase by approximately 25%. A year after he bought the house, Carl sold it for $246,000 (23% more than he paid).

A rational decision-maker who takes inflation into account should rank Adam first, Ben second, and Carl third, as Adam made a 2% profit in real terms, Ben realized a 1% loss in real terms, and Carl realized a 2% loss in real terms. However, people exhibiting money illusion may rank Carl first, Ben second, and Adam third, since, in nominal terms, Carl made a 23% nominal profit, Ben realized a 1% nominal loss, and Adam realized a 23% nominal

loss. In “Money Illusion”, a plurality of participants (47%) ranked Carl first, and majorities ranked Ben second (74%) and Adam third (54%), showing money illusion.

Results and Discussion

In our replication, Carl was selected as having had the best deal by a majority of participants (421/604, 70%); a majority indicated Ben as the one having made the second best deal (481/604, 80%); and a majority indicated Adam as the one having made the worst deal (456/604, 76%). We concluded that this replication was successful. If anything, our participants showed even stronger money illusion than in the original study, with larger majorities in favour of the house seller who made the best nominal profit (see Table 5 and Figure 2).

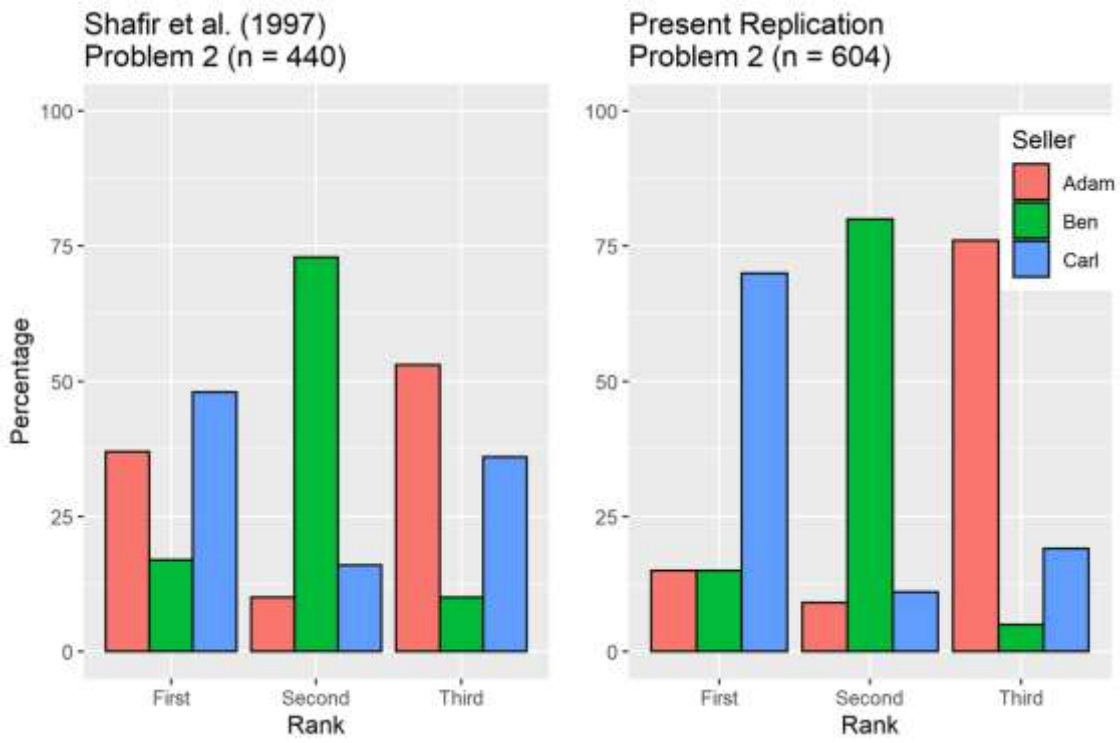

Figure 2. Problem 2: Comparison between original results and replication results.

Table 5

Problem 2: Original Study and Replication Results

	Original Problem 2, Rank					Replicated Problem, 2 Rank			
Seller	First	Second	Third	p-value	χ^2	First	Second	Third	p-value
Adam	160 (36% [32%, 41%])	43 (10% [8%, 13%])	228 (54% [49%, 58%])	< .001†	122.02†	92 (15% [13%, 18%])	56 (9% [7%, 12%])	456 (76% [72%, 79%])	< .001
Ben	73 (17% [13%, 20%])	315 (74% [69%, 77%])	43 (10% [8%, 13%])	< .001†	309.93†	91 (15%[13%, 18%]))	481 (80% [76%, 83%])	32 (5% [4%, 7%])	< .001
Carl	207 (47% [42%, 52%])	69 (16% [13%, 20%])	155 (36% [32%, 41%])	< .001†	67.69†	421 (70% [66%, 73%])	67 (11% [8%, 14%])	116 (19% [16%, 23%])	< .001
Total	440	427	426			604	604	604	

Note: † Recalculated p- value or effect size. P-values and chi-squares refer to tests of the actual distribution compared to a uniform distribution. The values in square brackets refer to 95% confidence intervals around proportions, calculated following the method described in Newcombe (1998).

Problem 3 Replication

In Problem 3, Shafir et al. (1997) tested whether people show money illusion in buying or selling decisions.

Methods

Participants were presented with a scenario describing a situation of high inflation in the United States, and were then asked whether they would be more likely to buy and sell an armchair compared to six months earlier, in counterbalanced order (see Table 6). They were randomly assigned to one of two groups, with one group viewing the monetary changes in questions described in dollar terms (n = 300) and the other group viewing the monetary changes in questions described in percentages (n = 304).

Participants replied to both the "buy" and the "sell" questions by indicating their likelihood to buy or sell the armchair at the present time by choosing one of three alternatives: "More likely"; "Same"; "Less likely".

Table 6

Problem 3: Scenario and Conditions

	Scenarios	
Introduction	Buy	Sell
Changes in the economy often have an effect on people's financial decisions. Imagine that the U. S. experienced unusually high inflation which affected all sectors of the economy. Imagine that within a six-month period all benefits and salaries, as well as the prices of all goods and services, went up by 25%. You now earn and spend 25% more than before.	Six months ago, you were planning to **buy** a leather armchair whose price during the 6-month period went up [from $400 to $500 / by 25%]. Would you be more or less likely to **buy** the armchair now?	Six months ago, you were planning to **sell** a leather armchair whose price during the 6-month period went up [from $400 to $500 / by 25%]. Would you be more or less likely to **sell** the armchair now?

Note: the text in brackets refers to the question description condition. See supplementary materials for further analysis regarding this factor.

Shafir et al. (1997) found that participants demonstrated money illusion in both conditions and were not neutral to inflation. In the "buy" decision, a large percentage reported that they would be *less* likely to buy the armchair (More: 7%; Same: 55%; Less: 38%), and in the "sell" decision, a large percentage of participants reported that they would be *more* likely to sell the armchair (More: 43%; Same: 42%; Less: 15%).

Results and Discussion

We found evidence of money illusion in both the "buy" decision (More: 6%; Same: 47%; Less: 47%) and the "sell" decision (More: 43%; Same: 49%; Less: 8%). The effect we found in the same direction and of very similar magnitude as the original (see Table 7 and Figure 3). We concluded that this was a successful replication.

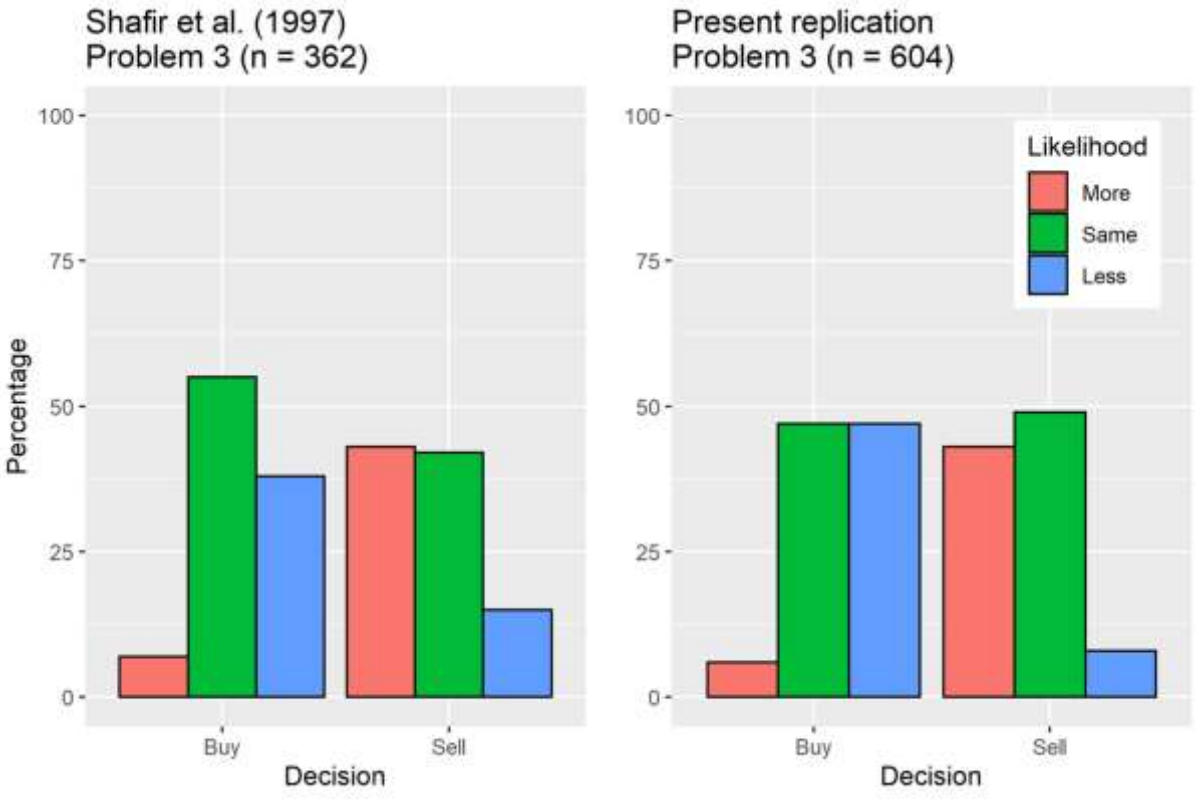

Figure 3. Problem 3: Comparison between original results and current replication.

Table 7

Problem 3: Original Study and Replication Results

	Original Problem 3			Replicated Problem 3		
	Buy Decisions	Sell Decisions	Total	Buy Decisions	Sell Decisions	Total
More	25 † (7% [4%, 10%])	156† (43%% [38%, 48%])	181	38 (6% [5%, 9%])	258 (43% [39%, 47%])	296
Same	199† (55% [50%, 60%])	152† (42% [37%, 47%])	351	285 (47% [43%, 51%])	298 (49% [45%, 53%])	583
Less	138† (38% [33%, 43%])	54† (15% [12%, 19%])	192	281 (47% [43%, 51%])	48 (8% [6%, 10%])	329
Total	362	362		604	604	
p-value*	< .001†	< .001†		< .001	< .001	

Note: †indicates a recalculated p- value or frequency.

* this p-value refers to a test of equality of proportions (each option being chosen by 1/3rd of participants)

The values in square brackets refer to 95% confidence intervals around proportions, calculated following the method described in Newcombe (1998).

Problem 4 Replication

In Problem 4, Shafir et al. (1997) found that participants were more risk-averse in real terms (and more risk-seeking in nominal terms) when the choice between the two contracts was presented by explaining real potential gains and losses, compared to when a decision was presented by highlighting potential nominal gains and losses or neutrally described.

Methods

Participants read a scenario presenting an estimate of future inflation, and were then randomly assigned to one of three groups (see Table 8 for the full wording). The first group of participants viewed contracts framed in real terms (n = 199) and then were asked to choose between contract A (risky in real terms, but riskless in nominal terms) and contract B (riskless in real terms, but risky in nominal terms). The second group of participants viewed the same contracts but framed in nominal terms (n = 200) and then were asked to choose between contract C (riskless in nominal terms, but risky in real terms) and contract D (risky in nominal terms, but riskless in real terms). The third group of participants viewed the same contracts but framed in neutral terms (n = 205) and then were asked to choose between contact E (riskless in nominal terms, but risky in real terms) and contract F (risky in nominal terms, but riskless in real terms). The wording of the conditions is presented in Table 7.

Table 8

Scenario and Conditions, Problem 4

Introduction	Contract type	Condition Real terms (*n* = 198)	Nominal terms (*n* = 200)	Neutral terms (*n* = 205)
Imagine it is now 1991, and you are the head of a corporate division located in Singapore that produces office computer systems. You are now about to sign a contract with a local firm for the sale of new systems, to be delivered in January 1993. These computer systems are currently priced at $1000 apiece but, due to inflation, all prices, including production costs and computer prices, are expected to increase during the next couple of years. Experts' best estimate is that prices in Singapore two years from now will be about 20% higher, with an equal likelihood that the increase will be higher or lower than 20%. The experts agree that a 10% increase in all prices is just as likely as a 30% increase. You have to sign the contract for the computer systems now. Full payment will be made only upon delivery in January 1993. Two contracts are available to you. Indicate your preference between the contracts by checking the appropriate contract below:	Risky contract in real terms (riskless in nominal terms)	Contract A: You agree to sell the computer systems (in 1993) at $1200 apiece, no matter what the price of computer systems is at that time. Thus, if inflation is below 20% you will be getting more than the 1993-price; whereas, if inflation exceeds 20% you will be getting less than the 1993-price. Because you have agreed on a fixed price, your profit level will depend on the rate of inflation.	Contract C: You agree to sell the computer systems (in 1993) at $1200 apiece, no matter what the price of computer systems is at that time.	Contract E: You agree to sell the computer systems (in 1993) at $1200 apiece, no matter what the price of computer systems is at that time.
	Riskless contract in real terms (risky in nominal terms)	Contract B: You agree to sell the computer systems at 1993's price. Thus, if inflation exceeds 20%, you will be paid more than $1200, and if inflation is below 20%, you will be paid less than $1200. Because both production costs and prices are tied to the rate of inflation, your "real" profit will remain essentially the same regardless of the rate of inflation.	Contract D: You agree to sell the computer systems at 1993's price. Thus, instead of selling at $1200 for sure, you will be paid more if inflation exceeds 20%, and less if inflation is below 20%.	Contract F: You agree to sell the computer systems at 1993's prices.

A rational risk-averse decision-maker should always choose contracts B, D, and F, since they guarantee the same *real* return at any inflation rate. However, a decision-maker affected by money illusion may choose contracts A, C, and E, since they promise a sure return at the nominal rate, but an uncertain return in real money. Shafir et al. (1997) found that when people were presented the problem in real terms, most people (81%) preferred contract B to contract A, i.e., they preferred the riskless contract to the risky contract. However, when they were presented the problem in nominal terms, people preferred contract D to contract C but to a lesser degree (59%). Finally, when participants were presented with the problem in neutral terms, they chose contract F over contract E to a lesser degree than in the real frame but similar to the preference exhibited in the nominal frame (54%).

Results and Discussion

We found that when people were presented the problem in real terms, most participants (69%) preferred contract B to contract A: in real terms, they preferred the riskless contract to the risky contract. When they were presented the problem in nominal terms, most participants (55%) preferred contract D to contract C. Finally, when participants were presented with the problem in neutral terms, a majority (51%) chose contract E over contract F. While the pattern of choices across conditions is slightly less pronounced than in the original, it is still very consistent with it, as are the omnibus statistical test and the single comparisons against 50%. We therefore concluded that this replication was successful (see Table 9 and Figure 4).

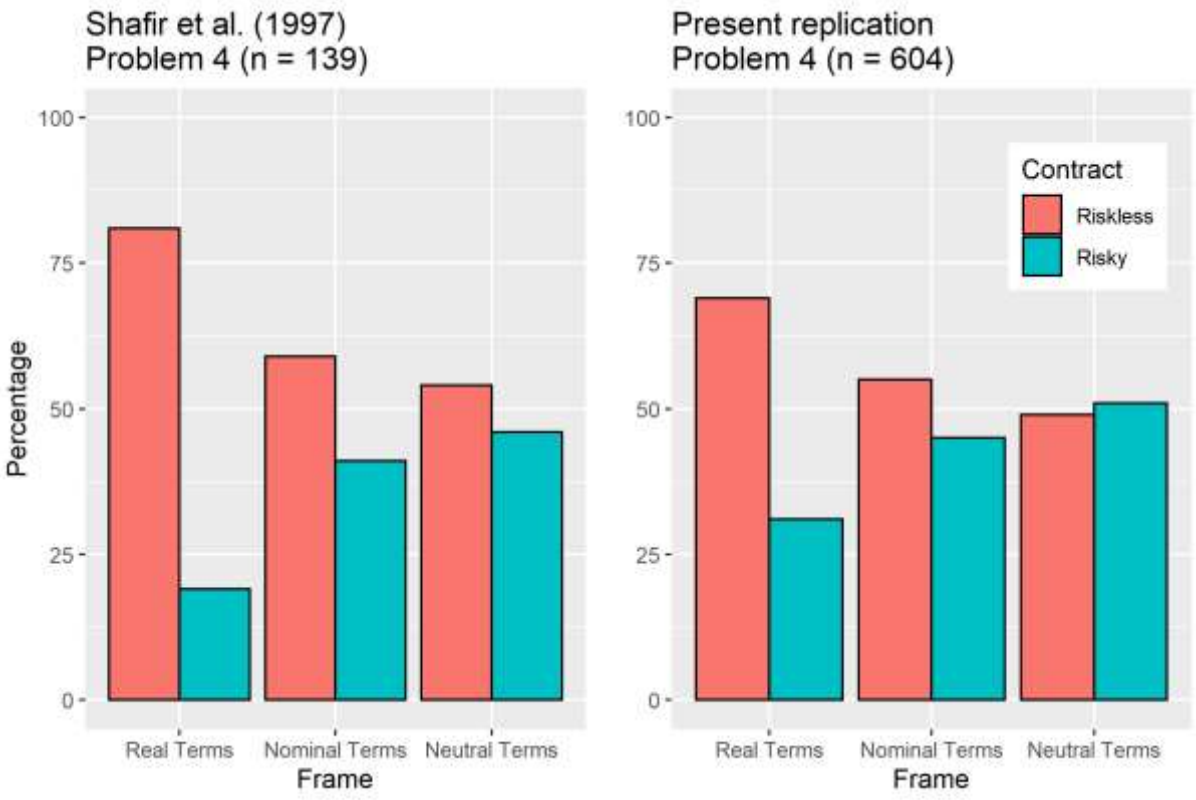

Figure 4. Problem 4: Comparison between original results and replication results. Riskless contracts (in nominal terms) are contracts B, D, and F, here indicated in red; risky contracts (in nominal terms) are contracts A, C, and E, here indicated in blue.

Table 9

Problem 4: Original Study and Replication Results

	Original Problem 4				Replicated Problem 4			
	Real Terms	Nominal Terms	Neutral Terms	Total	Real Terms	Nominal Terms	Neutral Terms	Total
Risky contract in real terms (riskless in nominal terms) (A/C/E)	9 (19% [10%, 33%])	20 (41% [28%, 55%])	20 (46% [33%, 61%])	49 (35% [28%, 43%])	62 (31% [25%, 38%])	90 (45% [38%, 52%])	105 (51% [44%, 58%])	257 (43% [39%, 47%])
Riskless contract in real terms (risky in nominal terms) (B/D/F)	38 (81% [68%, 90%])	29 (59% [45%, 72%])	23 (54% [39%, 67%])	90 (65% [57%, 72%])	137 (69% [62%, 75%])	110 (55% [48%, 62%])	100 (49% [42%, 56%])	347 (58% [53%, 61%])
Total	47	49	43	139	199	200	205	604
Binomial test p-value (against 50%)	< .001†	= .05†	= .11†	< .001†	< .001	= .16	= .73	< .001
Cramer's V, p-value across conditions*	V = 0.25 [0.13, 0.42]†, p < .001				V = 0.17, [0.10, 0.25], p < .001			

Note: † recalculated p- value or effect size. The values in square brackets refer to 95% confidence intervals around proportions, calculated following the method described in Newcombe (1998).

*Relative to a test of independence of proportion between condition and contract choice

Extension Results

For each problem, we conducted a series of binomial (Problems 1, 3, and 4) or multinomial (Problem 2 only) regression analyses, using participants' choices as the dependent variables and knowledge, tracking, care, their estimate of 2017 U.S. inflation and confidence in the estimate as the independent variable (for these last two factors, we included only the 48 participants who reported to know the inflation rate). Only two of these regressions obtained a statistically significant results (p = .03 and p = .024), but we caution against over interpreting them: since we ran many statistical tests, it is likely that some of them are statistically significant by chance alone. The results, presented in Table 10, suggest that none of these factors were associated with the extent of money illusion. Additional analyses presented in the supplementary materials (Tables S3 and S4) also do not find significant effects of any of these factors on the proposed dependent variables.

Table 10

Overview of Extension Results

Problem	Scenario	Knowledge	Tracking	Care	Confidence in estimate*	Inflation estimation*
Problem 1	Job scenario	χ^2 (1) = 0.21 *p* = .65	χ^2 (1) = 0.19 *p* = .67	χ^2 (1) = 0.57 *p* = .45	χ^2 (1) = 0.28 *p* = .60	χ^2 (1) = 0.22 *p* = .64
Problem 2**	Adam	χ^2 (2) = 5.26 *p* = .072	χ^2 (2) = 3.15 *p* = .21	χ^2 (2) = 2.08 *p* = .35	χ^2 (2) = 2.21 *p* = .33	χ^2 (2) = 0.02 *p* = .99
	Ben	χ^2 (2) = 2.78 *p* = .25	χ^2 (2) = 4.14 *p* = .13	χ^2 (2) = .59 *p* = .75	χ^2 (2) = 3.27 *p* = .20	χ^2 (2) = 0.01 *p* = .99
	Carl	χ^2 (2) = 7.48 *p* = .024	χ^2 (2) = 4.17 *p* = .12	χ^2 (2) = 0.54 *p* = .77	χ^2 (2) = 4.03 *p* = .13	χ^2 (2) = 0.45 *p* = .80
Problem 3	Buy	χ^2 (2) = 0.89 *p* = .64	χ^2 (2) = 2.95 *p* = .23	χ^2 (2) = 1.95 *p* = .38	χ^2 (2) = 4.38 *p* = .11	χ^2 (2) = 0.18 *p* = .91
	Sell	χ^2 (2) < .01 *p* > .99	χ^2 (2) = 3.05 *p* = .22	χ^2 (2) = 1.98 *p* = .37	χ^2 (2) = 3.24 *p* = .20	χ^2 (2) = 7.05 *p* = .03
Problem 4	Computer contract	χ^2 (2) = 0.41 *p* = .52	χ^2 (2) = 0.68 *p* = .41	χ^2 (2) = 0.37 *p* = .54	χ^2 (2) = 0.021 *p* = .89	χ^2 (2) = 0.018 *p* = .90

*Analyses restricted to the 48 participants who reported to know the inflation rate.
**Results of problem 2 were obtained by a multinomial regression analysis; for all the other problems, we used binomial regression.

General Discussion

More than 20 years since publication, and with a different sample, we successfully replicated Problems 1 to 4 of Shafir et al. (1997).

This successful replication adds to growing evidence from recent large scale replication efforts in judgment and decision-making (Collaborative Open-science REsearch, 2020; Hagen Cumulative Science Project, 2020) showing with high replicability rates (e.g., Chandrashekar et al., 2019; Chen, Yu, Feldman, & Zeng, 2020; Kutscher & Feldman, 2018; Ziano, Wang, et al., 2020), though with some challenges (e.g., Ziano, Kong, et al. 2020). We classified this replication as a "close replication", following guidelines presented by LeBel et al. (2018). This means that our replication was highly similar to the original study in terms of procedure and stimuli. All the quantitative findings present a statistically significant signal and are consistent with the original ones, following LeBel et al. (2019) (see Table 11).

Our extension found no support for the notion that paying attention, knowing, or caring about the actual inflation rate was associated with money illusion. Similarly, we found that neither the inflation rate estimate, nor the confidence in one's own inflation estimates were associated with money illusion. Notably, only a small minority of participants (8%) even reported that they knew the inflation rate. We interpret this as providing support for Shafir et al.'s (1997) explanation that the nominal representation of value is so salient that most people do not even worry about knowledge or tracking of the inflation rate and rely instead on the nominal value of money.

Table 11

Quantitative Comparison between Original and Replication Results

Problem	Original effect size [95% CI]	Replication effect size [95% CI]	Replication classification following LeBel et al. (2019)
Problem 1	V = 0.26 [0.17, 0.37]	V = 0.28 [0.21, 0.36]	Signal-consistent
Problem 2	48% [42%, 52%]*	70% [66%, 73%]*	Signal-inconsistent (stronger)
Problem 3 – buy	38% [33%, 43%]**	47% [43%, 51%]**	Signal-consistent
Problem 3 – sell	43%% [38%, 48%]***	43% [39%, 47%]***	Signal-consistent
Problem 4	V = 0.25 [0.13, 0.42]	V = 0.17 [0.10, 0.25]	Signal-consistent

Note. The interpretation column is according to the criteria set by LeBel et al. (2019).
* indicates that the effect size is the proportion of participants ranking the best nominal transaction as the best one overall
** indicates that the effect size is the proportion of participants being *less* likely to buy the armchair with high inflation
*** indicates that the effect size is the proportion of participants being *more* likely to sell the armchair with high inflation

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Money Illusion Shafir et al., (1997) replication: Supplementary materials

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Disclosures

Data and code

Data and code are shared using the Open Science Framework: https://osf.io/rv9mw/.

Pre-registrations and Qualtrics study designs

Pre-registration available on: https://osf.io/fve58 .

We note that several coauthored worked on this manuscript independently, peer reviewing one another, with each writing their own pre-registration, yet with one Qualtrics survey design. Pre-registrations were very similar, and we included the one that was most complete. We conducted our data analyses based on the most conservative/restrictive of those.

Procedure and data

Data collection

Data collection was completed before conducting an analysis of the data.

Conditions reporting

All collected conditions are reported.

Data exclusions

Details are reported in each of the two studies in the materials section of this document

Variables reporting

All variables collected for this study are reported and included in the provided data.

Notes about preregistration, analyses and sample

We note that the pre-registration plans included different references to possible exclusion criteria addressing generalized factors such as seriousness, English proficiency, etc. Analyses both with and without exclusions found that exclusions had little effect on the results. For reasons of brevity, the results reported below are without any exclusions.

A comparison of the target article sample and the replication samples is provided in Table S1 in the supplementary materials. Shafir et al (1997) conducted their surveys in two shopping malls in New Jersey and among Princeton undergraduates. However, they did not include descriptives details such as age and gender, and while they report total sample size per problem, they do not report from which sample they obtained each individual finding and whether there was any overlap across studies. We therefore recommend caution in comparing the original sample with our replication sample since information about the original one is poorly detailed.

Deviations from preregistration

Components in your preregistration	Were there deviations?	If yes - describe details of deviation(s)	Rationale for deviation	How might the results be different if you had not deviated
Extension results	Yes	We employed binomial logistic regression and multinomial logistic regression instead of chi-square independence tests	The chi-square independent test cannot be used for analyzing these results	Impossible to analyze the data with the pre-registered test

Additional analyses

Problem 1, binomial tests per conditions

Economic terms. A majority of participants (111/200, 55.5%) considered Ann better off compared to Barbara, in line with the original results, but this proportion did not reach conventional statistical significant in a binomial test against a 50% proportion, $p = .14$.

Happiness. A minority of participants (70/203, 34.5%) reported that they thought Ann was happier than Barbara, a proportion significantly different from 50%, $p < .001$, and in line with the original results.

Job attractiveness. A majority of participants (138/201, 69%) reported that they thought Ann was more likely to leave her job after a job offer from another firm, a proportion significantly different from 50%, $p < .001$, and in line with the original results.

We conducted a test for equality of proportions across problem presentations and found support for differences in judgments across problem presentation (χ^2 (2) = 48.20, $p < .001$, Cramer's V = .28, 95% CI [.21, .36]). We then ran Dwass-Steel-Critchlow-Fligner (DSCF) pairwise comparisons (which correct for multiple comparisons) in a Kruskal-Wallis non-parametric ANOVA. We found support for a difference between the economic terms presentation and the happiness presentation ($W = 5.99$, $p < .001$), for a difference between the economic terms presentation and the job attractiveness presentation ($W = -3.84$, $p = .018$), and for a difference between the happiness presentation and the job attractiveness presentation ($W = -9.71$, $p < .001$).

Significance testing analyses on original Problem 1

We performed significance testing of the original results, which yielded a significant effect and a similar effect size, χ^2 (2) = 24.60, $p < .001$, Cramer's V = .26, 95% CI [.17, .37]. A test for equality of proportion (since, without having the original data, it is impossible to perform the DSCF comparisons) comparing the economic terms presentation and the happiness presentation found a significant difference, χ^2 (1) = 21.90, $p < .001$; the comparison between the economic terms presentation and the job attractiveness condition, χ^2 (1) = 0.90, $p = .34$; the comparison between the job attractiveness condition and the economic terms presentation, χ^2 (1) = 14.04, $p < .001$. Overall, these analyses show similar results to the analyses we performed. We then proceeded to reverse the job attractiveness question as we did with the replication data. The overall test showed a significant effect, χ^2 (2) = 42.94, $p < .001$, Cramer's V = .35, 95% CI [.25, .45]. The new comparison between the economic terms and the new job attractiveness condition was significant, χ^2 (1) = 34.98, $p < .001$; the comparison between the happiness presentation and the new job attractiveness condition was not significant, χ^2 (1) = 0.20, $p = .89$, in line with the replication results.

Recoded "job attractiveness" condition, Problem 1

By recoding the job attractiveness such that the person indicated by participant is the one less likely to leave her job (i.e., presumably the one more satisfied with her job), we found a significant omnibus effect (χ^2 (2) = 28.74, $p < .001$; Cramer's V = .22, 95% CI [.15, .30]), confirming that participants judgments changed across problem presentation. We then ran DSCF comparisons in a Kruskal-Wallis non-parametric ANOVA, which found support for a difference between the economic terms presentation and the happiness presentation ($W =$

5.99, $p < .001$); support for a difference between the economic terms presentation and the job attractiveness presentation ($W = 6.89$, $p < .001$); but no support for a difference between the happiness presentation and the job attractiveness presentation ($W = -0.95$, $p = .78$). This last comparison shows that people's judgments of happiness were in line with their judgments of job attractiveness.

Problem 2

We conducted three proportion tests (one per seller) against a uniform distribution of choices for each of the three choices (a situation in which each participant has an equal likelihood – 1/3 - of being ranked first, second, or third). All of them were significantly different from a uniform distribution (Adam: χ^2 (2) = 486.41, $p < .001$; Ben: χ^2 (2) = 591.36, $p < .001$; Carl: χ^2 (2) = 365.47, $p < .001$).

Additional analyses, study 3

As in the original study, we found that there was no significant effect of the presentation in dollar terms or in percentage terms (see supplementary materials). Collapsing across this factor, both buy decisions (χ2 (2) = 198.80, p < .001) and sell decisions (χ2 (2) = 179.14, p < .001) were significantly different from a uniform distribution, and the patterns of proportions are very close to the original results, (see Table 3).

We conducted proportion tests against a uniform distribution of choices for each of the four problem variants (a situation in which each choice has an equal likelihood – 33.3% - of being selected). We found that the distribution of answers was significantly different from a uniform distribution in all cases (Buy, dollars: χ^2 (2) = 91.76, $p < .001$; Buy, percentages: χ^2 (2) = 108.76, $p < .001$; Sell, dollars: χ^2 (2) = 77.82, $p < .001$; Sell, percentages: χ^2 (2) = 102.13, $p < .001$). We then conducted two tests for equality of proportions to test whether the presentation in dollars or percentages significantly affected money illusion, but we found no evidence that different presentation affected either buy decisions, χ^2 (2) = 2.11, $p = .35$, Cramer's V = .06, 95% CI [-.06, .14], or sell decisions, , χ^2 (2) = 2.43, $p = .30$, Cramer's V = .06, 95% CI [-.06, .15]. Note that the 95% CI around Cramer's V includes pseudo-lower bonds (Signorell, 2016) since Cramer's V is bounded between 0 and 1.

Problem 4

We found that when people were presented the problem in real term, most people (137/199, 69%) preferred contract B to contract A, i.e., they preferred the riskless contract to the risky contract, a proportion higher than 50% (χ^2 (1) = 28.29, $p < .001$). When they were presented the problem in nominal terms, most people (110/200, 55%) preferred contract D to contract C, a proportion not significantly different from 50% in real terms (χ^2 (1) = 2.00, $p = .16$). Finally, when participants were presented with the problem in neutral terms, a majority (105/205, 51%) chose contract E over contract F, a proportion that was not significantly different from 50% (χ^2 (1) = 0.12, $p = .73$). We concluded that this replication was successful. People showed higher money illusion when the same problem was illustrated in real terms rather than in nominal or neutral terms (see Table 4 and Figure 4).

We ran a test for equality of proportions, which found an overall effect of framing on contract choice (χ^2 (2) = 17.36, $p < .001$; Cramer's V = .17, 95% CI [.10, .25]). We conducted DSCF comparisons in a Kruskal-Wallis ANOVA, which showed that choices in the real terms condition were significantly different from choices in the nominal condition (W = -4.02, $p = .012$), choices in the real condition were significantly different compared to the neutral terms

condition (W = -5.78, $p < .001$), and choices in the nominal terms condition were not significantly different compared to the neutral terms condition (W = -1.77, $p = .42$).

Tables

Table S1

Difference and similarities between original studies and replication attempts

	Shafir et al 1997 problem 1	Shafir et al 1997 problem 2	Shafir et al 1997 problem 3	Shafir et al 1997 problem 4	Present replication
Sample size	358	431	362	139	604
Geographic origin	US American	US American	US American	US American	US American
Gender	Not reported	Not reported	Not reported	Not reported	288 males, 315 females, 1 other
Average age (years)	Not reported	Not reported	Not reported	Not reported	40.1 years old
Medium (location)	Paper questionnaire (two New Jersey shopping malls; Princeton University)	Paper questionnaire (two New Jersey shopping malls; Princeton University)	Paper questionnaire (two New Jersey shopping malls; Princeton University)	Paper questionnaire (two New Jersey shopping malls; Princeton University)	Computer (online)
Compensation	Not reported	Not reported	Not reported	Not reported	Nominal payment
Year	Not reported (on or before 1997)	Not reported (on or before 1997)	Not reported (on or before 1997)	Spring of 1991	2018

Table S2

Results of Problem 3 replication, differences between dollar terms and percentages terms

	In Dollar Terms (a)			In percentages (b)		
	Buy Decision	Sell Decisions	Total	Buy Decisions	Sell Decisions	Total
More	22 (7%)	125 (42%)	147	16 (5%)	133 (44%)	149
Same	134 (45%)	146 (49%)	280	151 (50%)	152 (50%)	303
Less	144 (48%)	29 (10%)	173	137 (45%)	19 (6%)	156
Total	300	300		304	304	
P-value	< .001	< .001		< .001†	< .001†	

Note: † recalculated p- value or effect size

Table S3

Binomial regressions, Problem 1 extension

	Knowledge	Care	Tracking	Confidence	Estimate
B (SE)	0.24 (0.31)	-0.11 (0.08)	0.27 (0.30)	-0.22 (0.34)	0.02 (0.03)
p- value	0.43	0.18	0.37	0.21	0.54

Note. The analyses for confidence level and the estimate are restricted to the 48 participants who reported to know the inflation rate in the USA in 2017. These analyses differ from the ones reported in the main body as here, we conducted five binomial regressions, each with one of the factors in the table as IV and the participants' choice (Ann or Barbara) as DV.

Table S4

Binomial regressions, Problem 4 extension

	Knowledge	Care	Tracking	Confidence	Estimate
B (SE)	-0.43 (0.32)	< .001 (0.08)	-0.43 (0.31)	< .001 (0.35)	-0.003 (0.027)
p- value	0.18	0.99	0.17	> 0.99	0.91

Note. The analyses for confidence level and the estimate are restricted to the 48 participants who reported to know the inflation rate in the USA in 2017. These analyses differ from the ones reported in the main body as here, we conducted five binomial regressions, each with one of the factors in the table as IV and the participants' choice (riskless or risky contracts in real terms) as DV.

Table S5

Classification of the replications presented here, based on LeBel et al. 2017

Design facet	In this replication
IV operationalization	same
DV operationalization	same
IV stimuli	same
DV stimuli	same
Procedural details	different
Physical settings	different
Contextual variables	different
Replication classification	Close replication

Preregistration

Introduction

The theory of Money Illusion has received wide recognition as well as been extensively studied in the field of economics. Irving Fisher also devoted an entire book to this phenomenon approximately seventy years ago (*The Money Illusion*, 1928). This theory emphasizes the tendency of individuals to think and make decisions in terms of nominal rather than real monetary values. The aim of this study is to shed light on the psychology underlying the money illusion and thus aims to replicate the effects of four of the seven scenarios presented in the Shafir et. al (1997) article.

Hypotheses

Overall, we expect that money illusion arises from an interaction between nominal and real representations of economic transactions, with a bias towards a nominal evaluation.

Problem 1 – Earnings

When economic terms are emphasized, individuals are more likely to evaluate the scenario in terms of real monetary values rather than nominal values. When non-economic terms are emphasized, individuals are more likely to evaluate the scenario based on nominal terms rather than real terms.

Problem 2 – Transactions

When individuals are given a scenario involving a transaction described in both real and nominal terms, majority of their evaluations will be based on nominal representations.

Problem 3 – Transactions

In an inflationary context, when buying and selling decisions are to be made, more individuals will be willing to sell at a higher nominal price (no change in real price) and less likely to buy at a higher nominal price (no change in real price).

Problem 4 – Contracts

When presented with two contracts (risky v/s riskless) that are framed in either real, nominal or neutral terms, individuals are more likely to evaluate the contracts based on real representations (when real is emphasized) and more likely to evaluate based on nominal representations (when nominal or neutrally framed).

Extension

We hypothesize that people with a low awareness of changes of prices in the daily lives would be less clear about the concept of real or nominal terms in the perfectly simple economic models in the problems, thus would show higher degree of biases towards nominal representation in the problems.

Method

Design

This study is designed as a between-subjects experimental study.

- <u>Problem 1 – Earnings based</u>
  - Independent Variable (IV): Earnings of two individuals
    - Condition 1: Economic status
    - Condition 2: Happiness

    - Condition 3: Job Attractiveness
  - Dependent Variable (DV): Preference of one individual over the other

- Problem 2 – Transaction based
  - Independent Variable (IV): Single scenario presented- housing transactions presented in a deflationary, normal and inflationary context
  - Dependent Variable (DV): Evaluation of best transaction

- Problem 3 – Transaction based
  - Independent Variable (IV): Inflationary context in consumer goods
    - Condition 1: Inflationary rate provided
    - Condition 2: Exact inflationary amount provided
  - Dependent Variable (DV): Buying decision, Selling decision

- Problem 4 – Contracts based
  - Independent Variable (IV): Economic contracts
    - Condition 1: Two contracts framed in real terms
    - Condition 2: Two contracts framed in nominal terms
    - Condition 3: Two contracts framed in neutral terms
  - Dependent Variable (DV): Decision to choose a contract

Planned Sample

All experiments will be run with at least 166 participants from the USA recruited online by using Amazon Mechanical Turk. The sample size was determined through a power analysis based on the effect sizes found in the classic experiments (Power: 1- β = 0.95, Significance: alpha = 0.05). The complete power analysis is provided in Appendix I.

Procedure

A Qualtrics survey will be used for this study. The survey design is attached to the project at the end to reconstruct the idea. The entire Qualtrics survey can be found in the Supplementary materials.

In the original article, each participant was presented with just one scenario, but in our replication, every participant will see all 4 scenarios (random assignment of participants to the conditions in each scenario).

Results

Full description of results from the original study

1. Sample size before exclusion:
   - Problem 1: 358 (Economic term N=150, Happiness N=69, Job Attractiveness N=139)
   - Problem 2: 431
   - Problem 3: 362
   - Problem 4: 139 (Real term: N=47, Nominal term: N=49, Neutral term: N=43)

2. Sample size after exclusion: Unreported, no exclusion criteria mentioned in the article.

3. Included sample: The original study was conducted with three different populations namely; airline passengers, shoppers and students. People at Newark International

Airport, two New Jersey shopping malls (Menlo Park Mall in Edison and Woodbridge Center Mall in Woodbridge) and undergraduate students at Princeton University were randomly selected and presented with a questionnaire.

4. Results/Statistics:

a. Problem 1:
   - When economic terms were emphasized, majority of participants (71%) thought in real monetary terms. When happiness and job attractiveness was measured, majority of participants tended towards nominal decisions (64%-65%).

	Ann	Barbara
Economic term	71%	29%
Happiness	36%	64%
Job attractiveness	65%	35%

b. Problem 2:
   - Evaluation of the best deal was made based on nominal thinking by majority participants. The transaction that had a nominal gain but a real loss was chosen as the best deal (48%) and the transaction with a nominal loss but a real gain was chosen as the worst deal (53%).

	Adam	Ben	Carl
1st	37%	17%	48%
2nd	10%	73%	16%
3rd	53%	10%	36%

c. Problem 3:
   - Manipulations of the IV had no effect on preferences. The decision to buy or sell a consumer good during times of inflation (whether rate or amount was provided) was based on nominal representations of the transactions. Higher nominal prices were conducive to selling and aversive to buying. The proportion of participants who were more and less likely to buy and sell differed significantly.

     ($\chi 2 = 128$, $p < 0.0001$).

	More	Same	Less
Buying	7%	55%	38%
Selling	43%	42%	15%

d. Problem 4:
   - In the first condition with contracts framed in real terms: Majority of participants opt for the riskless option (81%).

- In the second condition with contracts framed in nominal terms: More participants now choose the riskless nominal contract (but risky real contract), in contrast to condition 1 (19% in condition 1 increases to 41% now). Lesser participants now choose the risky nominal contract (but riskless real contract), (81% reduces to 59% now). There is a significant shift in preferences.
  ($\chi 2 = 5.34$, $p = 0.02$).

- In the third condition with contracts framed in neutral terms: The pattern of decisions is similar to condition 2. More participants opt for the nominally riskless contract. There is a significant difference between preferences observed in conditions 1 and 3.
  ($\chi 2 = 7.7$, $p < 0.01$).

Real term	A: 19%	B: 81%
Nominal term	C: 41%	D: 59%
Neutral term	E: 46%	F 54%

Data Analysis Plan

1. Problem 1
   a. Economic Terms

- Statistical test: A one-sample proportion test will be conducted to assess whether the distribution deviates from a distribution with random chance (50-50).
- IV: Earnings of two individuals; DV: Preference of one over the other
- Options: Ann or Barbara
- Expected results: A higher proportion of participants would choose Ann (Higher real economic gain)

b. Happiness

- Statistical test: A one-sample proportion test will be conducted to assess whether the distribution deviates from a distribution with random chance (50-50).
- IV: Earnings of two individuals; DV: Preference of one over the other
- Options: Ann or Barbara
- Expected results: A higher proportion of participants would choose Barbara (Higher nominal gain)

c. Job Attractiveness

- Statistical test: A one-sample proportion test will be conducted to assess whether the distribution deviates from a distribution with random chance (50-50).
- IV: Earnings of the two individuals; DV: Preference of one over the other
- Options: Ann or Barbara
- Expected results: A higher proportion of participants would choose Barbara (Higher nominal gain)

d. Economic Terms vs Happiness

- Statistical test: A chi-square test will be conducted to see if the distribution of economic terms deviates from the distribution of happiness.
- Options: Ann or Barbara
- Expected results: A higher proportion of participants would choose Ann for economic terms but Barbara for happiness.

e. Happiness vs Job Attractiveness

- Statistical test: A chi-square test will be conducted to see if the distribution of happiness deviates from the distribution of job attractiveness.
- Options: Ann or Barbara
- Expected results: A higher proportion of participants would choose Barbara for happiness but Ann for job attractiveness.

2. Problem 2
    a. Statistical test: A one-sample proportion test will be conducted to assess whether the distribution deviates from a distribution with random chance (1/3, 1/3, 1/3 split).
    b. IV: Single scenario-Housing transactions in times of deflation, normal and inflation; DV; Evaluation of best transaction.
    c. Expected results: A higher proportion of participants will tend towards the transaction with a nominal gain but real loss.

3. Problem 3
    a. Statistical test: A chi-square test will be conducted to see if there is a difference between people's buying and selling decisions in the same economic context (alpha=0.05).
    b. IV: Inflation rate and inflation amount; DV: Buying decision, selling decision
    c. Options: More likely, Same, Less likely
    d. Expected results: During times of inflation, people tend to think in nominal terms and thus are more prone to selling and aversive to buying (even though real prices are the same).

4. Problem 4:
    a. Statistical test: A chi-square test will be used to assess whether there is a typical difference between people's assessment of similar contracts when framed in different ways (alpha=0.05).
    b. IV: Contracts framed in real, nominal and neutral terms; DV: Choosing a contract
    c. Expected results: People will be more focused on the real values of money while choosing contracts framed in real monetary values, but will be influenced by the easiness of nominal judgments (ignoring real values) when the equivalent contracts are framed in nominal and neutral terms.

Extension

(added in this replication that are not included in the original article)

The authors observed the anomalous phenomenon of confusion between money's nominal and real worth in people's conversations. People's understanding on money's nominal and real worth can be evaluated by their awareness of current inflation or deflation status, which is a basic information for application of the concept.

Independent variable:

The participants' understanding on inflation, evaluated by answering the following questions:

a. Knowledge of the inflation rate

Question: Do you know the US 2017 inflation rate (for the 12 months ended January 2018)? (Yes or No)

Additional exploratory factors:

For those who indicate yes in (a),

b. Accuracy of the knowledge of inflation rate

Question: Write the US 2017 inflation rate in percentages (allow 2 decimal points). The range acceptable range is within 0.5 deviation from the correct answer 2.1%.

c. Confidence on knowledge of inflation rate

the Question: Please rate your confidence in the accuracy of the answer to the previous question, on a scale of 1 to 5, where 1 means "Not confident at all" and 5 means "Very Confident." (5-point scale)

d. Presence of habit of keeping track of inflation rate

Question: Do you usually keep track of the inflation rate? (Yes or No)

e. Level of care on the inflation rate

Question: How much do you care about the inflation rate? (5-point scale)

A chi-square independence test will be used to evaluate the correlation.

Complete Original Scenarios

Problem 1

Consider two individuals, Ann and Barbara, who graduated from the same college a year apart. Upon graduation, both took similar jobs with publishing firms. Ann started with a yearly salary of

$30,000. During her first year on the job there was no inflation, and in her second year Ann received a 2% ($600) raise in salary. Barbara also started with a yearly salary of $30,000. During her first year on the job there was a 4% inflation, and in her second year Barbara received a 5% ($1500) raise in salary.

Economic terms (N = 150):

As they entered their second year on the job, who was doing better in economic terms?

Ann: 71% Barbara: 29%

Happiness (N = 69):

As they entered their second year on the job, who do you think was happier?

Ann: 36% Barbara: 64%

Job attractiveness (N = 139):

As they entered their second year on the job, each received a job offer from another firm. Who do you think was more likely to leave her present position for another job?

Ann: 65% Barbara: 35%

Problem 2 (N = 431):

Suppose Adam, Ben, and Carl each received an inheritance of $200,000, and each used it immediately to purchase a house. Suppose that each of them sold the house a year after buying it. Economic conditions, however, were different in each case:

* When Adam owned the house, there was a 25% deflation—the prices of all goods and services decreased by approximately 25%. A year after Adam bought the house, he sold it for $154,000 (23% less than he paid).

* When Ben owned the house, there was no inflation or deflation—prices had not changed significantly during that year. He sold the house for $198,000 (1% less than he paid for it).

* When Carl owned the house, there was a 25% inflation—all prices increased by approximately 25%. A year after he bought the house, Carl sold it for $246,000 (23% more than he paid).

Please rank Adam, Ben, and Carl in terms of the success of their house-transactions. Assign '1' to the person who made the best deal, and 3 to the person who made the worst deal.

Problem 3 (N = 362):

Changes in the economy often have an effect on people's financial decisions. Imagine that the U. S. experienced unusually high inflation which affected all sectors of the economy. Imagine that within a six-month period all benefits and salaries, as well as the prices of all goods and services, went up by approximately 25%. You now earn and spend 25% more than before.

Six months ago, you were planning to buy a leather armchair whose price during the 6-month period went up from $400 to $500. Would you be more or less likely to buy the armchair now?

More: 7% Same: 55% Less: 38%

Six months ago, you were also planning to sell an antique desk you own, whose price during the 6-month period went up from $400 to $500. Would you be more or less likely to sell your desk now?

More: 43% Same: 42% Less: 15%

Problem 4:

Imagine that you are the head of a corporate division located in Singapore that produces office computer systems. You are now about to sign a contract with a local firm for the sale of new systems, to be delivered in January, 1993.

These computer systems are currently priced at $1000 apiece but, due to inflation, all prices, including production costs and computer prices, are expected to increase during the next couple of years. Experts' best estimate is that prices in Singapore two years from now will be about 20% higher, with an equal likelihood that the increase will be higher or lower than 20%. The experts agree that a 10% increase in all prices is just as likely as a 30% increase.

You have to sign the contract for the computer systems now. Full payment will be made only upon delivery in January, 1993. Two contracts are available to you. Indicate your preference between the contracts by checking the appropriate contract below:

Contracts framed in real terms:

Contract A: You agree to sell the computer systems (in 1993) at $1200 a piece, no matter what the price of computer systems is at that time. Thus, if inflation is below 20% you will be getting more than the 1993-price; whereas, if inflation exceeds 20% you will be getting less than the 1993-price. Because you have agreed on a fixed price, your profit level will depend on the rate of inflation. [19%]

Contract B: You agree to sell the computer systems at 1993's price. Thus, if inflation exceeds 20%, you will be paid more than $1200, and if inflation is below 20%, you will be paid less than $1200. Because both production costs and prices are tied to the rate of inflation, your "real" profit will remain essentially the same regardless of the rate of inflation. [81%]

Contracts framed in nominal terms:

Contract C: You agree to sell the computer systems (in 1993) at $1200 apiece, no matter what the price of computer systems is at that time. [41%]

Contract D: You agree to sell the computer systems at 1993's price. Thus, instead of selling at $1200 for sure, you will be paid more if inflation exceeds 20%, and less if inflation is below 20%. [59%]

Contracts under a neutral frame:

Contract E: You agree to sell the computer systems (in 1993) at $1200 a piece, no matter what the price of computer systems is at that time. [46%]

Contract F: You agree to sell the computer systems at 1993's prices. [54%]